FEED ROLLERS FOR TREE HANDLING

Reference to Related Application

[0001] This is a continuation-in-part of Application No. 10/345,212 filed on 16 January 2003 and entitled Feed Rolls for Tree Handling Equipment.

Technical Field

[0002] This invention relates to rolls for feeding logs through tree handling equipment such as delimbers, tree processors and the like.

Background

[0003] Some tree delimbers include a pair of curved knives that can be brought into contact with the outer surface of a log. The log is pulled past the knives which shear off any limbs projecting from the log. In typical tree delimbers the log is moved by compressing it between a pair of counter-rotating feed rollers. The feed rollers grip the log and move it along. Examples of tree delimbers which work in this general manner are the SIDEWINDER™ and LIM-MIT™ delimbers made by Risley Manufacturing Ltd. of Grande Prairie, Alberta, Canada.

[0004] Some existing feed rollers are faced with spikes to enable them to better grip the outer surface of a log. These spikes can incise the outer layer of wood of the log, which is undesirable.

[0005] Other commonly-used feed rollers comprise a rubber-coated cylinder having a chain mesh stretched over its outer surface. These feed rollers, while reducing damage to the log surface, suffer from relatively short service lives and can be undesirably expensive.

[0006] Commonly-owned U.S. patent No. 4,972,890 describes a type of feed roller which comprises a cylindrical drum having contour-edged bars bolted to its outer surface. The contour-edged bars are relatively

widely spaced apart. These feed rollers have not been completely successful, because they can cause chipping of the outer surface of logs.

[0007] Despite the variety of feed rollers available for use in tree processing machinery there remains a need for feed rollers which improve on the performance and/or cost effectiveness of current feed rollers.

Summary of the Invention

[0008] One aspect of the invention provides a feed roller for handling trees. The feed roller comprises a rotatable support member and a plurality of elongated strips coupled to the support member. The strips extend substantially parallel to one another in a cylindrical configuration. Each of the strips has a leading edge having a plurality of spaced apart projections. The leading edge projections interdigitate with projections on a trailing edge of an adjacent one of the strips.

[0009] Another aspect of the invention provides a feed roller for tree handling. The feed roller comprises a drum having a longitudinal axis and a substantially cylindrical surface. A plurality of strips are spaced apart around a circumference of the drum. The strips extend substantially parallel to the longitudinal axis. Each strip has a leading edge and a trailing edge. Each strip has projections on its leading and trailing edges. The projections on the leading edge of each strip interdigitate with projections on a trailing edge of an adjacent strip. Each strip has a first end extending into a first pocket at a first end of the surface and a second end extending into a second pocket at a second end of the surface.

[0010] Yet another aspect of the invention provides a feed roller for tree handling. The feed roller comprises a substantially cylindrical drum having a longitudinal axis and a plurality of metal strips spaced apart around a circumference of the drum. The strips extend substantially

parallel to the longitudinal axis. Each metal strip has a leading edge and a trailing edge. The leading edge is shaped to provide projections. The trailing edge has a shape complimentary to the shape of the leading edge of an adjacent one of the strips. The projections on the leading edge of each metal strip interdigitate with projections on a trailing edge of an adjacent one of the metal strips. The strips are coupled to the drum by a coupling. The coupling permits the strips to rock from side to side.

[0011] A further aspect of the invention provides a replacement tree gripping member for a feed roll for tree handling. The tree gripping member comprises a strip of metal having a textured outer face. An inner face of the strip bears a band of a material. The material of the band is resilient, has a static coefficient of friction with steel not exceeding 1, or is both resilient and has a static coefficient of friction with steel not exceeding 1. The strip has a wavy leading edge comprising a plurality of projections, and a wavy trailing edge comprising a plurality of projections complementary to the leading edge projections. The band of material is narrower than the strip.

[0012] Further features and aspects of the invention are described below.

Brief Description of Drawings

[0013] In Figures which illustrate non-limiting embodiments of the invention:

Figure 1 is a side elevation of a prior art tree delimbing machine which includes a pair of feed rollers;

Figure 2 is an enlarged end view of the feed roller portion of the machine of Figure 1 equipped with feed rollers according to this invention;

Figure 3 is a cross-section through a feed roller;

Figure 4 is a perspective view of a feed roller according to one embodiment of the invention;

Figure 5 illustrates a front elevation view of a strip according to an alternative embodiment of the invention;

Figure 6 is a transverse cross section through a portion of the feed roller of Figure 4;

Figure 7 is a longitudinal cross section through a portion of the feed roller of Figure 4;

Figure 8 is a transverse cross section through a portion of a feed roll according to an alternative embodiment of the invention;

Figure 9 is an isometric view of a feed roller according to a further alternative embodiment of the invention;

Figure 10A and 10B are respectively front and rear isometric views of one strip from the feed roller of Figure 9; and,

Figure 11 is a schematic transverse cross section through one end of one of the strips of the feed roller of Figure 9.

Description

[0014] Throughout the following description, specific details are set forth in order to provide a more thorough understanding of the invention. However, the invention may be practiced without these particulars. In other instances, well known elements have not been shown or described in detail to avoid unnecessarily obscuring the invention. Accordingly, the specification and drawings are to be regarded in an illustrative, rather than a restrictive, sense.

[0015] This invention relates to feed rollers for feeding logs. Such feed rollers may be used in various applications. Feed rollers may be used, for example, in roll-stroke delimbers.

[0016] Figure 1 illustrates a roll-stroke delimber **10** having a slidably displaceable boom **12** with a tree grapple **14** and saw **16** mounted at the free end of boom **12**. Boom **12** is rotatably and pivotably supported above platform **18**. Platform **18** is in turn mounted on a pair of treads **20** which may be driven in conventional fashion to propel delimber **10** relative to felled trees that are to be delimbed.

[0017] Roll-stroke delimber **10** may be actuated by its operator to tightly close grapple **14** about the butt of a felled tree and to retract boom **12** and, with it, the tree, toward log feed roller mechanism **22**. Once grapple **14** is released, log feed roller mechanism **22** grips the tree and feeds it backwardly through tree guide tube **45**. The tree is delimbed as its branches strike the arms of grapple **14** or cutters (not shown) mounted at the forward end of tube **45**. Once the tree has been delimbed, log feed roller mechanism **22** may be actuated to propel the delimbed tree forwardly through tree guide tube **45**. Saw **16** may then be actuated at selected intervals to buck the delimbed tree into desired lengths.

[0018] Log feed roller mechanism **22** (Figure 2) comprises a pair of feed rollers **24**, **26** mounted parallel to one another (i.e. the longitudinal axes of rollers **24**, **26** are parallel to one another and remain generally parallel to one another throughout the operation of delimber **10**). A "drive means", such as a hydraulic motor **30** (Figure 3) is connected to drivably counter-rotate rolls **24**, **26** about their respective longitudinal axes. That is, motor **30** is capable of rotating roller **24** in either of the two directions illustrated by arrows **31** (Figure 3). Similar provision is made for bidirectional rotation of roller **26**. Other arrangements of driveshafts, motors, engines, etc. could be provided to turn one or both of feed rollers **24**, **26**. In the illustrated embodiment, a motor **30** is mounted inside each feed roller **24**, **26**.

[0019] Figure 4 shows a feed roller **110** according to one embodiment of this invention. Feed roller **110** comprises a cylindrical drum **112** having a longitudinal axis **114** and an outer surface **116**. A flange **117** inside drum **112** permits drum **112** to be mounted for rotation on a tree handling machine such as, for example, a tree delimber. First and second rings **118** and **119** extend circumferentially around drum **112** at longitudinally spaced-apart locations. Each of rings **118** and **119** is spaced apart from outer surface **116** by spacers **121**.

[0020] In the illustrated embodiment, rings **118** and **119** each comprise a plurality of arc-shaped sectors **120** which can be independently dismounted from drum **112**. Sectors **120** are held in place by bolts **122** or other suitable fasteners.

[0021] A plurality of longitudinally extending strips **124** substantially cover the face of feed roller **110**. Each strip **124** has a first end **124A** engaged under first ring **118** and a second end **124B** engaged under second ring **119**. Strips **124** have leading edges **126** and trailing edges **128**. Leading edges **126** are shaped to have a plurality of longitudinally spaced-apart projections **130**. Each trailing edge **128** has a shape which is complementary to leading edge **126** of the adjacent strip **124**. Projections **130** on leading edges **126** interdigitate with complementary projections **132** on trailing edges **128**.

[0022] It can be seen that, in general, feed roller **110** comprises a rotatable support member to which are coupled a plurality of elongated strips **124**. In the illustrated embodiment, the support member comprises drum **112**. Strips **124** extend substantially parallel to one another and to an axis of rotation of drum **112**. Strips **124** are arranged in a cylindrical configuration.

[0023] In the illustrated embodiment, leading and trailing edges **126**, **128** have wavy shapes such that projections **130** and **132** are rounded. Strips **124** may be called "contour-edged". Figure 5 shows a strip **124'** according to an alternative embodiment of the invention. Strip **124'** has leading and trailing edges **126**, **128,** shaped to provide projections **130** and **132** that have flattened ends **130A**, **132A**.

[0024] Outer faces **133** of strips **124** are textured to enhance frictional contact with a log. In the embodiment of Figure 4, V-bars **134** are affixed to outer faces **133**. In the embodiment of Figures 10A and 10B outer faces of the strips **24** are provided with a pattern of pyramidal projections.

[0025] An inner face **136** (see Figure 6) of each strip **124** is faced with a layer **140** of a resilient material. Layer **140** may, for example, comprise a layer of rubber, urethane or ceramic-impregnated urethane bonded to inner face **136**. In some embodiments layer **140** is resilient. In such embodiments layer **140** may have a hardness of 80 or less on the Shore scale. In some embodiments, layer **140** has a hardness in the range of 25 to 45 on the Shore scale. In some embodiments, layer **140** has a harness in the range of 25 to 35 on the Shore scale. In some embodiments, layer **140** has a thickness in the range of about ½ inches to about 3 inches.

[0026] The construction of feed roller **110** permits strips **124** to rock slightly from side to side, as indicated by arrows **142** (Figure 7), under the forces encountered when feed roller **110** bears against a log.

[0027] Strips **124** are preferably fabricated of a material which, if bent slightly, will spring back to its original shape. In one embodiment, strips **124** are fabricated from QT-100 steel (as defined by CSA standard 640.21/M). The resilience of strips **124** and the ability of layer **140** to yield

under pressure permits strips **124** to flex inwardly and outwardly, as indicated by arrows **143** (Figure 6), under the forces encountered when feed roller **110** bears against a log.

[0028] Strips **124** are captured by rings **118** and **119,** but are free to float slightly. Longitudinal movement of strips **124** is limited by abutment surfaces on strips **124**. In the illustrated embodiment of Figure 6, the abutment surfaces comprise steps **144** on outer faces **133**. Abutment surfaces could also be provided by other projections from strips **124**, which can abut against part of the feed roller, such as rings **118** and **119**, which are fixed to drum **112**. Circumferential motion of strips **124** is limited by adjacent strips **124**. Strips **124** may each be free to float circumferentially relative to drum **112** until they contact an adjacent strip **124**.

[0029] Strips **124** may be dimensioned so that, when strips **124** are equally spaced-apart around drum **112**, leading edge **126** of each strip **124** is separated from the trailing edge **128** of an adjacent strip **124** by a narrow gap **146** (Figure 4). During use, gaps **146** tend to become packed with wood fibres and other fine debris. This further locks strips **124** together and provides some cushioning between adjacent strips **124**.

[0030] Figure 8 shows a section through a portion of a feed roller **210** according to an alternative embodiment of the invention. Feed roller **210** is similar to feed roller **110,** except that a layer **240** of resilient material is affixed to surface **116** of drum **112**. Strips **224** of the Figure 8 embodiment may lack the layer **140** of resilient material of strips **124** of the Figure 7 embodiment. Strips **224** are free to float slightly, as described above and can flex inwardly and outwardly and rock slightly under the forces exerted on them when feed roller **210** bears against a log. Layer **240** preferably has a hardness of 80 or less on the Shore scale. In some

embodiments, layer **240** has a hardness in the range of 25 to 45 on the Shore scale. In some embodiments, layer **240** has a hardness in the range of 25 to 35 on the Shore scale.

[0031] Figures 9, 10A and 10B show a feed roller **320** according to further alternative embodiment of the invention. Feed roller **324**, comprises a cylindrical drum **312**. Strips **324** are spaced apart around drum **312.** Each strip **324** has a leading edge **326** and a trailing edge **328**. Leading and trailing edges **326, 328** of adjacent strips **324** are respectively shaped to provide interdigitating projections **330** and **332**.

[0032] Each strip **324** has end portions **325A** and **325B**. End portions **325A** and **325B** are received in pockets **350** in retaining members **352** and **353**. In the illustrated embodiments, each retaining member **352**, **353** comprises a plurality of removable segments **356**. Each segment **356** has recesses **350A** which provide pockets **350** when the segment is affixed to drum **310**. A strip **324** may be removed for servicing or replacement by removing the segments **356** at one or both of its ends.

[0033] In the illustrated embodiment, segments **356** are held in place by fasteners, in particular bolts **357A** and nuts **357B**. Segments **356** may be affixed to drum **310** by other types of fastener or in any other suitable manner.

[0034] Figures **10A** and **10B** show a strip **324** in more detail. In this embodiment, each strip **324** has a band **360** of a resilient and/or slippery material extending along its inner-facing side. An outer-face of the illustrated strip **324** is textured. In the illustrated embodiment the texture is provided by an array of flattened pyramidal protrusions. Band **360** may, for example, comprise a suitable grade of nylon, urethane, Teflon™, or the like. Band **360** is preferably but not necessarily continuous. Band **360**

may, for example, be made up of a row of pads affixed to a strip **324**. In the illustrated embodiment, band **360** is retained in a longitudinal channel in the body of strip **324**.

[0035] In some embodiments band 360 has a static coefficient of friction with a material of the surface of drum 312 which does not exceed 1. In some embodiments the static coefficient of friction between the material of drum 312 and the material of band 360 does not exceed 4×10^{-1}. Bands 360 are narrow enough and/or longitudinal edge portions of bands 360 are compressible enough to permit strips 324 to rock from side to side as shown in Figure 7. If band 360 is made of a slippery material then rocking may involve a strip 324 rotating about a longitudinally-extending axis while the corresponding band 360 slides across the surface of drum 312 in a direction transverse to strip 324. If band 360 is made of a compressible material then rocking may involve one side of band 360 becoming compressed.

[0036] Pockets **350** provide a means for positively driving strips **324**. Preferably as shown in Figure 11, strips **324** fit somewhat loosely in pockets **350** so that strips **324** can slide transversely, as indicated by arrow **373**. Pockets **350** also hold strips **324** loosely enough to permit strips **324** to rock as indicated by arrow **374**.

[0037] In the illustrated embodiments, strips **324** have abutment surfaces **344** which, when the ends of strips **324** are engaged in pockets **350**, can bear against corresponding surfaces **345** of segments **356**. Preferably abutment surfaces **344** are spaced somewhat more closely than surfaces **345** so that strips **324** are not prevented from sliding slightly longitudinally relative to drum **312**.

[0038] Retaining members **352** and/or **353** may have patterns of projections on their surfaces. Retaining members **352** and/or **353** optionally have faces which are angled inwardly toward strips **324**. This may help to maintain logs in engagement with strips **324** in some cases.

[0039] Strips as described in relation to any of the above embodiments may be supplied as replacement parts for feed rollers according to the invention.

[0040] As will be apparent to those skilled in the art in the light of the foregoing disclosure, many alterations and modifications are possible in the practice of this invention without departing from the spirit or scope thereof. For example:

- one of rings **118** and **119** or one of retaining members **352** and **353** could be non-removably mounted to drum **112**;
- one or both of rings **118** and **119** could be replaced with other attachment means which permit strips **124** or **224** to float slightly;
- feed rolls according to the invention may be used in any context in which it is desired to feed a tree longitudinally;
- In embodiments having pockets (for example pockets **350**) the pockets could be formed, in part, by radial walls which are rigidly affixed to a drum.

Accordingly, the scope of the invention is to be construed in accordance with the substance defined by the following claims.